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THE GENUS *FONTIGENS* FROM APPALACHIAN CAVES (HYDROBIIDAE: MESOGASTROPODA)

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ABSTRACT

Fontigens holsingeri *Hubricht from Harman Cave, Randolph Co., West Virginia, and* Fontigens turritella *Hubricht from McClung Cave, Greenbrier Co., West Virginia are described as new species. Additional geographical records are given for* Fontigens orolibas *Hubricht,* Fontigens aldrichi *(Call & Beecher),* Fontigens tartarea *Hubricht,* and Fontigens nickliniana *(Lea).*

Fontigens holsingeri *new species*

Fig. 1A

Description: Shell small, conical, diameter about 65% of height, thin, translucent, dull, pale yellowish-horn; umbilicus open, about 0.1 mm. in diameter; nuclear whorl nearly flat, later whorls regularly increasing in size, well rounded with very deep sutures, each whorl lightly appressed to the preceding whorl; sculpture of numerous inconspicuous growth lines; aperture ovate, vertical, may or may not be appressed to the preceding whorl; lip thin, sharp, with a very slight thickening within. Operculum paucispiral, thin, of about 3.5 whorls, hyaline, the nucleus being located about one-half way between the center and the lower right margin. Animal unpigmented and blind, verge unknown.

Height 1.7 mm., diameter 1.1 mm., aperture height 0.6 mm., aperture width 0.5 mm., umbilicus diameter 0.1 mm., 4.5 whorls. Holotype.

Distribution: West Virginia: Randolph Co.: stream in Harman Cave, 0.5 mile southwest of Harman (Type locality) (J. R. Holsinger & D. C.

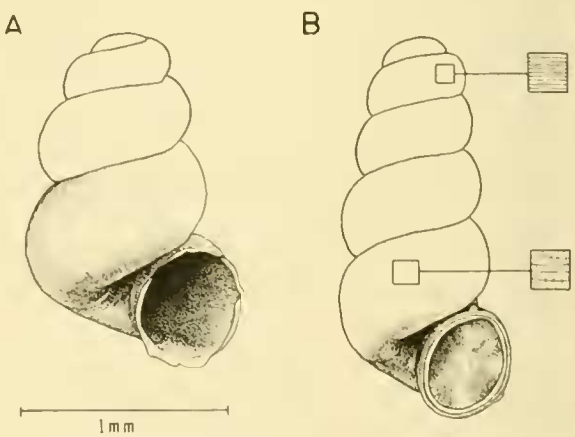

FIG. 1A. Fontigens holsingeri *Hubricht, holotype. Length, 1.7 mm.*

FIG. 1B. Fontigens turritella *Hubricht, holotype. Length, 1.9 mm. Drawings courtesy Field Museum of Natural History, Chicago, with thanks to Elizabeth Liebman for her skilled efforts.*

Culver, colls.), holotype 170893 and paratypes 170392 Field Museum of Natural History, other paratypes 42560 and 43635 collection of the author; stream in Bazzle Cave, 1.0 mile south-southeast of Harman (J. R. Holsinger & D. C. Culver, colls.). Pocahontas Co.: stream in Piddling Pit Cave, 10 miles north-northeast of Marlington (J. R. Holsinger, R. Baroody, & R. Swensson, colls.); stream in Marthas Cave, 0.9 miles southwest of Hillsboro (David Culver & David Newson, colls.).

Remarks: Fontigens holsingeri is most closely related to *F. cryptica* Hubricht; differing in being larger, with more rounded whorls, and a more open umbilicus. *Fontigens tartarea* Hubricht, which is found in the same area differs in its flatter whorls and shallower sutures.

Fontigens turritella *new species*

Fig. 1B

Description: Shell small, conical, turreted, diameter about 48% of height, thin, pale straw colored, translucent, dull; nuclear whorl depressed, giving the shell a truncated appearance, later whorls regularly increasing in size, well rounded with deep sutures; sculpture of very weak growth lines and spiral lines; aperture ovate, vertical, lightly appressed to the preceding whorl; lip thin, sharp, with a very slight thickening within, not reflected in the columellar region. Operculum paucispiral, thin, hyaline, of about 2.5 whorls, the nucleus located left of center. Animal unpigmented and blind.

Verge with three lobes, the upper lobe slender, cylindrical, less than one-third the length of the other two lobes, and attached near the base of the center lobe; the center lobe and the lower lobe are joined together along most of their length, with only their tips separate, they excede in length the diameter of the shell; the center lobe contains the spermathecal duct, the other lobes contain much smaller ducts of unknown function.

Height 1.9 mm., diameter 0.9 mm., aperture height 0.5 mm., aperture width 0.5 mm., 5.5 whorls. Holotype.

Distribution: West Virginia: Greenbrier Co.: stream in McClungs Cave, 2 miles northeast of Maxwelton (Type Locality) (John Rutherford; Leslie Hubricht, colls.), holotype 170891 and paratypes 170890 FMNH, other paratypes 38272 and 40694, collection of the author; stream in The Hole Cave (Gibbs Entrance Section), 2 miles east of Frankford (J. R. Holsinger, D. Culver, P. Starr, S. Peck, & D. Newson, colls.).

Remarks: Fontigens turritella differs from all the species known from Appalachian caves except *F. nickliniana* (Lea) by its elongate shape, its height exceeding twice the diameter. From *F. nickliniana* it differs in its verge, in its smaller size, in its truncated spire, and more slowly increasing whorls.

Fontigens aldrichi (Call & Beecher)

Paludina obtusa Lea. 1841. Proc. Amer. Phil. Soc. **2**: 34. (Not. *P. obtusa* Troschel. 1837).

Bythinella aldrichi Call & Beecher. 1886. Bull. Washburn Coll. Lab. Nat. Hist. **1**: 190-192.

Amnicola aldrichi aldrichi (Call & Beecher). Hubricht, L. 1940. Nautilus **53**: 118-119.

Snails found in springs and caves from northwestern Virginia north to Maryland are not distinguishable from snails found in the eastern Ozarks of Missouri. The spring form with eyes and dark gray pigment were collected at the following localities: *Virginia:* Highland Co.: spring, 0.7 mile southwest of Mustoe; spring, 1.3 miles north of Mustoe. Both of these springs are in the headwaters of the Jackson River.

The blind unpigmented cave form was found at the following localities: *Virginia:* Bath Co.: stream in Butler Cave, 1 mile north of Burnsville (J. R. Holsinger, T. Vigour, & L. Vinzant, colls.). Frederick Co.: stream in Ogdens Cave, 3.5 miles west-northwest of Middletown. *Maryland:* Washington Co.: beneath stones, large spring, 0.4 mile south of Little Heiskell Quarry (F. Wayne Grimm, coll.).

It is probable that during the Pliocene, *Fontigens aldrichi* lived in springs in the northern United States but was forced south by the Pleistocene glaciers. Because the kind of springs in which it lived were covered over by till, it was not able to move back into its old range and has survived only in the Appalachians, the eastern Ozarks, and if the type locality for *Paludina obtusa* is correct, in Ohio.

Fontigens orolibas Hubricht

Fontigens orolibas Hubricht. 1957. The Nautilus **71**: 9.

An unpigmented form of this species, which may or may not have eyes, has been collected in the following caves: *Virginia:* Warren Co.: stream in Skyline Caverns, 2 miles south of Front Royal. Giles Co.: stream in Smoke Hole Cave, Newport (J. R. Holsinger & H. R. Steeves, colls.); stream in Tawneys Cave, near Newport; stream in Starnes Cave, 3.5 miles south-southeast of Narrows (J. R. Holsinger & S. Hetrick, colls.). Tazewell Co.: stream in Hugh Young Cave, 1.5 miles southwest of Liberty Hill (J. R. Holsinger, coll.).

Fontigens tartarea Hubricht

Fontigens tartarea Hubricht. 1963. Nautilus **76:** 140.

Since this species was described it has been found living in the following caves: *West Virginia:* Tucker Co.: stream in Harpers Cave, 5 miles southeast of Hendricks (J. R. Holsinger & D. C. Culver, colls.). Randolph Co.: stream in Simmons-Mingo Cave, 1.5 miles southwest of Mingo (R. B. Williams, coll.); stream in Bowden Cave, 7 miles east of Elkins (J. R. Holsinger & D. C. Culver, colls.). Monroe Co.: stream in Indian Draft Cave, a few miles south of Wayside (J. R. Holsinger, D. C. Culver, & R. Baroody, colls.); stream in Rock Camp Cave, 1.6 miles south of Rock Camp; stream in McClungs Cave, Zenith.

Specimens from Bowden Cave are very small: height 1.2 mm., diameter 0.7 mm., and are probably the smallest freshwater snails known from the eastern United States.

Fontigens nickliniana (Lea)

Paludina nickliniana Lea. 1839. Trans. Amer. Phil. Soc. n. s. **6:** 92.

Fontigens nickliniana (Lea). Pilsbry. 1933. Nautilus **47:** 12.

What appears to represent a blind, white, cave form of this species has been collected at the following localities: *West Virginia:* Monroe Co.: stream in Hunt Cave, near Sinks Grove (J. R. Holsinger, coll.). *Virginia:* Lee Co.: stream in Gallohan Cave No. 1, 6.5 miles southeast of Rose Hill (J. R. Holsinger, coll.); stream in Spangler Cave, 3.5 miles west of Jonesville (J. R. Holsinger, coll.); pool in Smiths Milk Cave, 7 miles southeast of Rose Hill (J. R. Holsinger, D. C. Culver, colls.). The verge has not been examined from any of these lots. It is very difficult to kill cave hydrobiids relaxed.

REPRODUCTION AND EARLY DEVELOPMENT OF THE OCEAN QUAHOG, ARCTICA ISLANDICA, IN THE LABORATORY

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ABSTRACT

The ocean quahog, Arctica islandica, *normally spawns in summer in southern New England. Attempts to ripen these bivalves out of season in the laboratory produced limited success. Clams obtained from the Rhode Island fishery in late winter and kept in seawater ranging from 10°C to 15°C ripened significantly in five weeks, but clams subjected to the same temperatures, plus supplemental feeding with cultured algae in the fall, failed to produce gametes. Ripe clams could not be induced to spawn by rapidly increasing temperature, rapidly decreasing temperature, changing the salinity, or by sperm suspension. Fertilization and the per cent development of stripped eggs to normal larvae were significantly increased when the eggs were exposed to dilute ammonium hydroxide before fertilization was attempted. The eggs developed to the veliger*